APPLICATION OF AERMOD AND CALPUFF MODELS FOR POWER PLANT PERMITTING IN THE MDAQMD

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Outline of Presentation

- AERMOD Regulatory status and applicability
- Brief Overview of AERMOD and CALPUFF
- AERMOD implementation in Southern California
- Application of AERMOD and CALPUFF for permitting the Victorville 2 Hybrid Power Project (VV2)

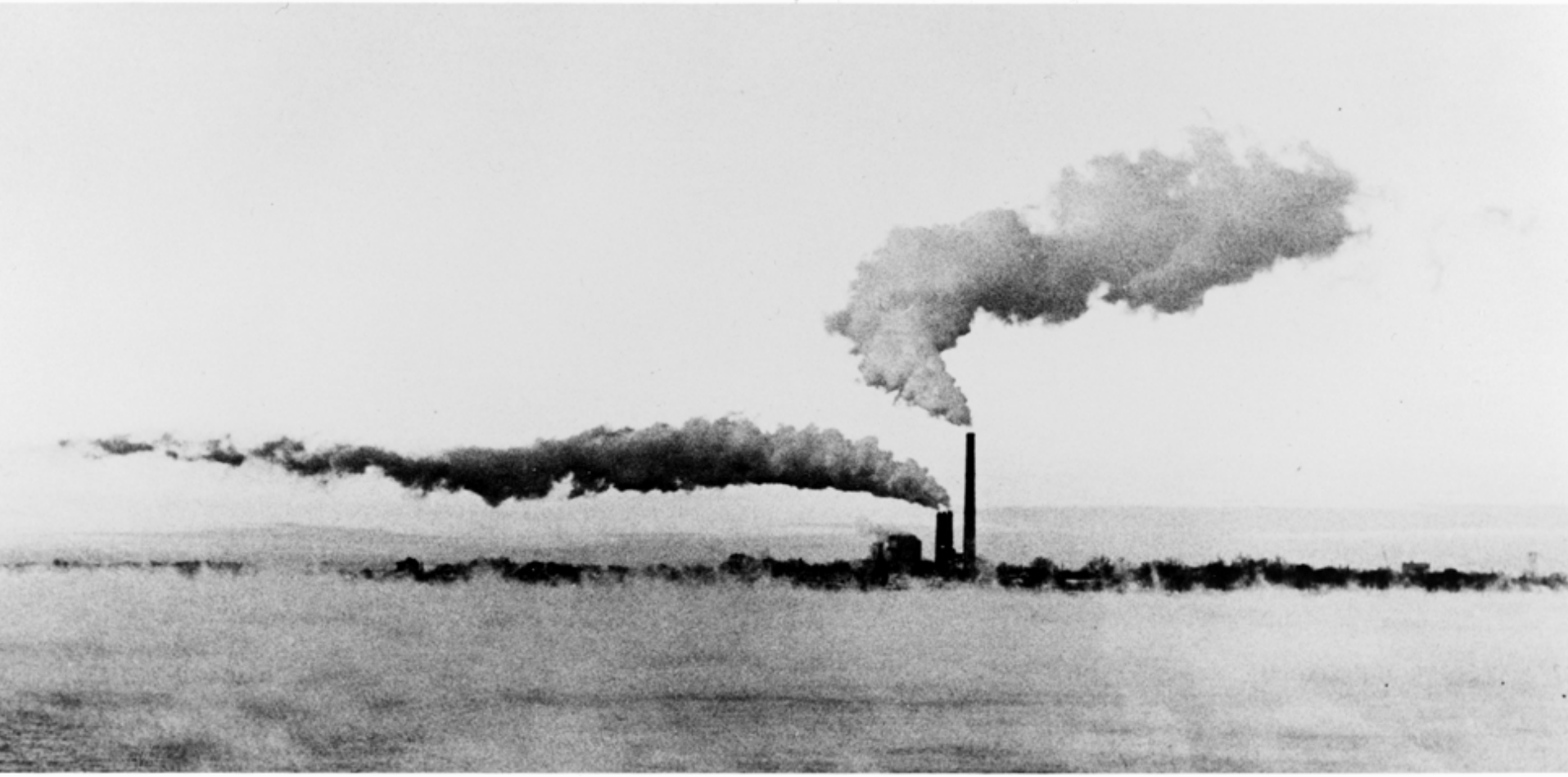
AERMOD Regulatory Status and Applicability

- AERMOD is now an EPA Guideline Model, replacing ISCST3
- Applicable for distances up to 50 km
- Promulgated 9 Dec 2005
- ISCST3 cannot be used for Federal programs after 9 Dec 2006
- First major short-range model promulgation in 25 years

Summary of AERMOD Improvements

- AERMOD is based on a newer understanding of atmospheric turbulence and dispersion
- AERMOD solves many identified problems with ISCST3 including
  - Dispersion in complex terrain
  - Building wake impacts
  - Characterization of turbulence
- The issue of ISCST3 over-predictions in complex terrain is eliminated
- The “Look and Feel” of AERMOD is the same as ISCST3

AERMOD Can Model This!

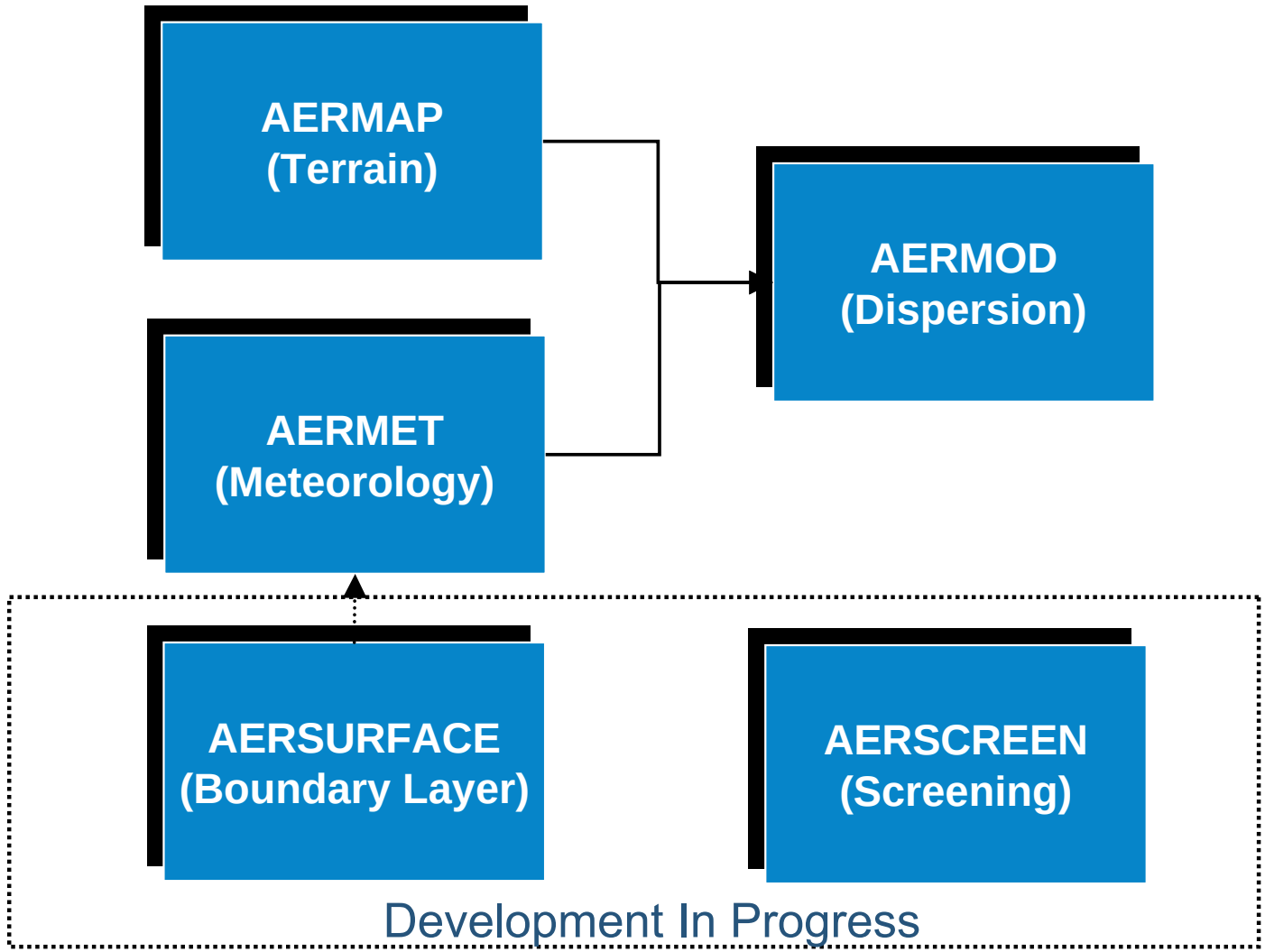


(Photo: Ralph Turcotte, Beverly (Massachusetts) Times, kindly provided by Bruce Egan

Comparison of ISCST3 and AERMOD

- ISCST3:
  - Single surface file
  - Dispersion parameters based on Stability Class
  - Hourly mixing height
- AERMOD:
  - Surface file
  - Vertical profile file with multiple levels
  - Dispersion potential computed directly from micrometeorological parameters
  - Mixing height replaced by newer boundary layer concepts

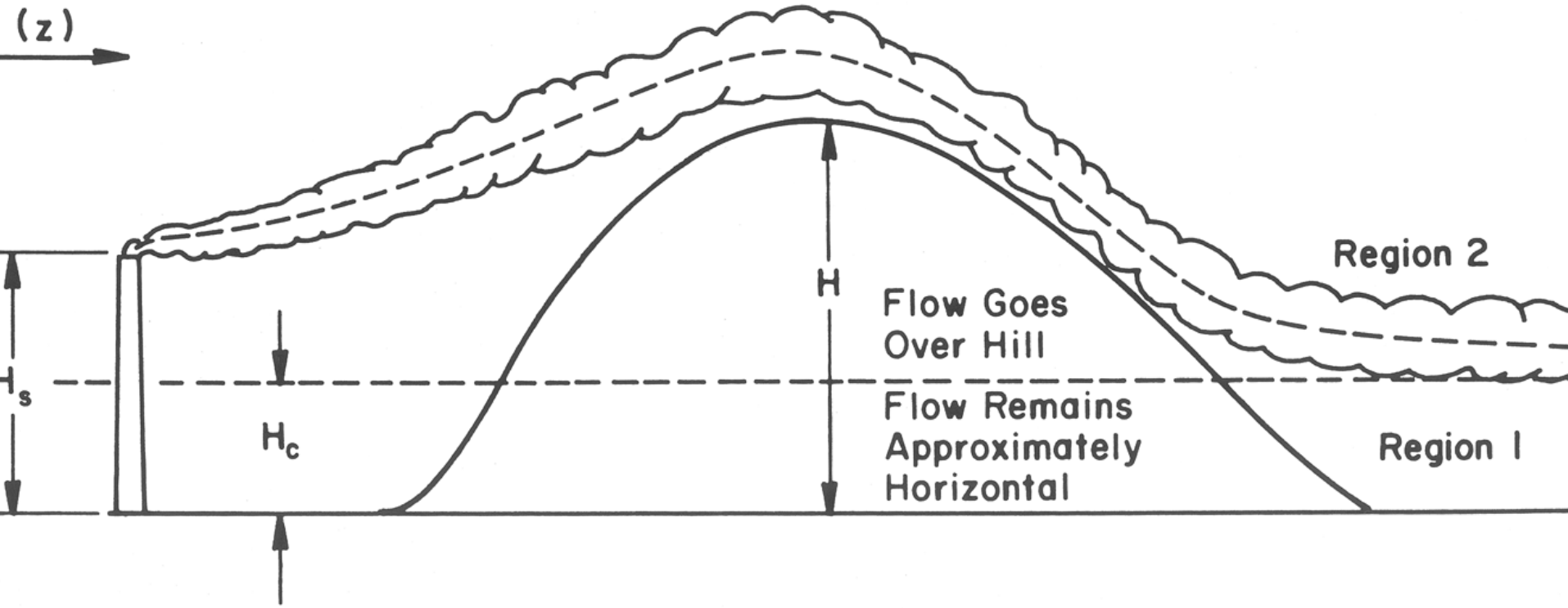
AERMOD Modeling System Structure



AERMOD Also Model This!

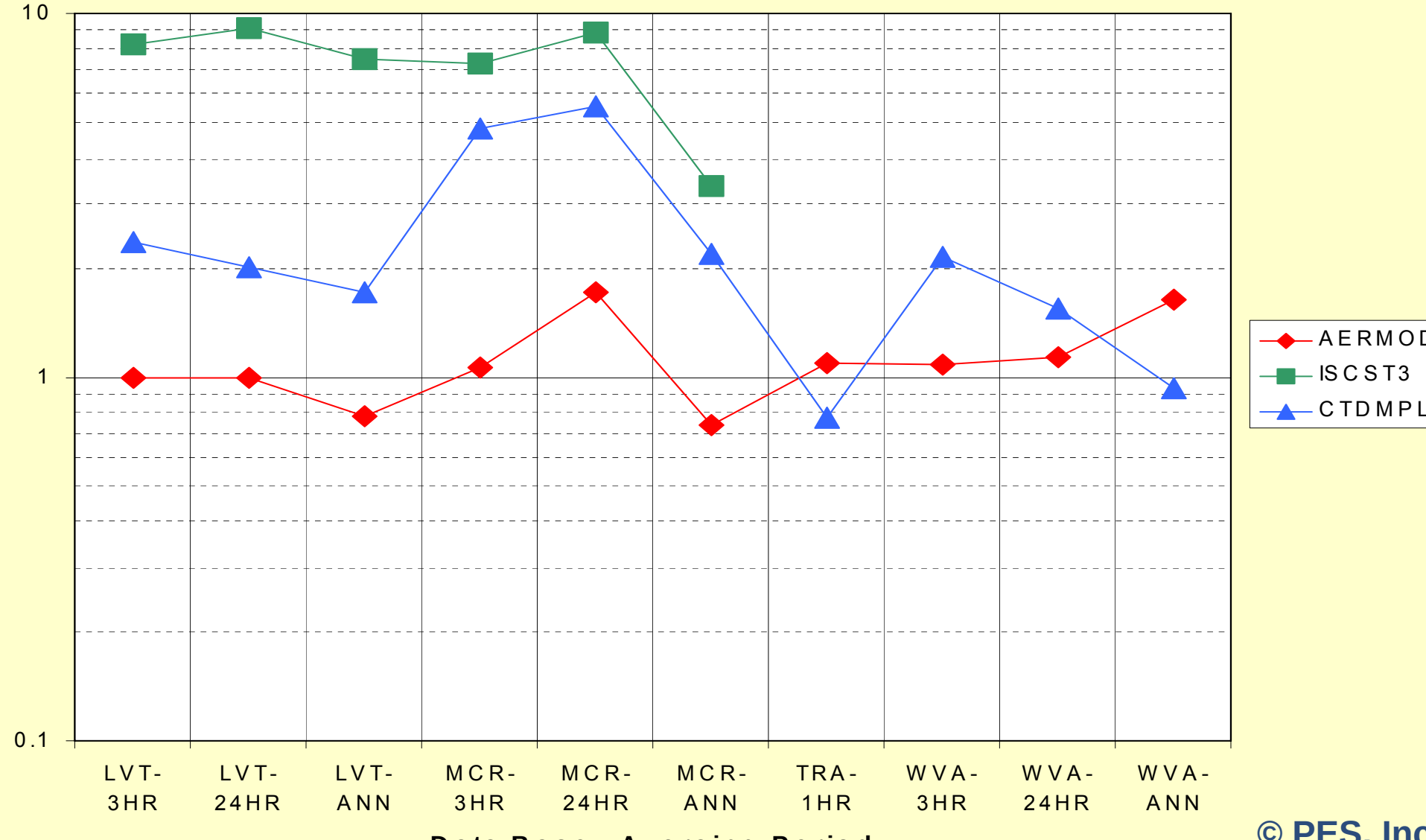
From Slade, 1968

AERMOD Simulation of Plume Behavior in Stable Flow



From Venkatram and Wyngaard, 1988

Peak Concentration Predicted/Observed Ratios for Complex Terrain



CALPUFF is an Integrated Modeling System

Meteorological model (CALMET)

- Observational data (surface and aloft)
- Prognostic models (MM5, ETA, RUC2, RAMS)

Non-steady-state Lagrangian puff dispersion model (CALPUFF)

- All distances out to 300 km
- EPA approved for distances 50 km to 300 km

Pre- and post-processing modules

- Terrain elevation and land use geophysical data
- Surface and upper air meteorological data
- Precipitation data
- Cloud observations
- Visibility and deposition flux calculations

Would You Choose ISCST3, AERMOD, or CALPUFF for This Source?

mplementation of AERMOD in Southern California
Air Resources Board
(Michele Houghton)

- ARB is upgrading HARP to allow use of AERMOD
  - External file format for dispersion model input to HARP
  - Greenhouse gases reporting added
  - HARP Beta Version by end of 2006
- No current plans to hold AERMOD training courses for District staff

mplementation of AERMOD in Southern California
Mojave Desert AQMD / Antelope Valley AQMD
(Richard Wales)

- District has no current AERMOD capability
- Two current power plant projects are using AERMOD
  - Victorville 2 Hybrid Power Project
  - Palmdale Hybrid Power Project
- District staff need training in AERMOD and meteorological data preparation

mplementation of AERMOD in Southern California
South Coast AQMD
Tom Chico)

- Looking at development of MM5-based AERMOD meteorological data sets
- Will involve 3-5 years of data at multiple sites from offshore to Coachella Valley
- System will allow creation of AERMOD files at arbitrary locations
- Will likely require approval by EPA

mplementation of AERMOD in Southern California
San Diego APCD
(Ralph DeSiena)

- District has AERMOD expertise
  - Otay Mesa Power Plant
  - Palomar Energy Project
  - Other current work
- Developing ~ 10 AERMOD meteorological data sets in-house using SDAPCD monitoring data
- Data spans 3 years
- Completed Chula Vista

mplementation of AERMOD in Southern California
/entura County APCD
Terry Thomas)

- Current modeling involves HARP only
- No immediate plans to switch to AERMOD
- Will migrate to AERMOD when HARP is upgraded
- Looking to ARB for guidance on meteorological data needs and AERMOD training

Expect to Buy a Faster Computer

Real World ENSR Permit Modeling AERMOD Run

87.6 hours elapsed time for one run

- 3.0 GHz Intel XEON Workstation
- 317 Sources:
  - 72 point sources (60 w/ downwash)
  - 236 volume sources
  - 9 area sources
- 3,563 Receptors
- 1.13 Million Source-Receptor Pairs

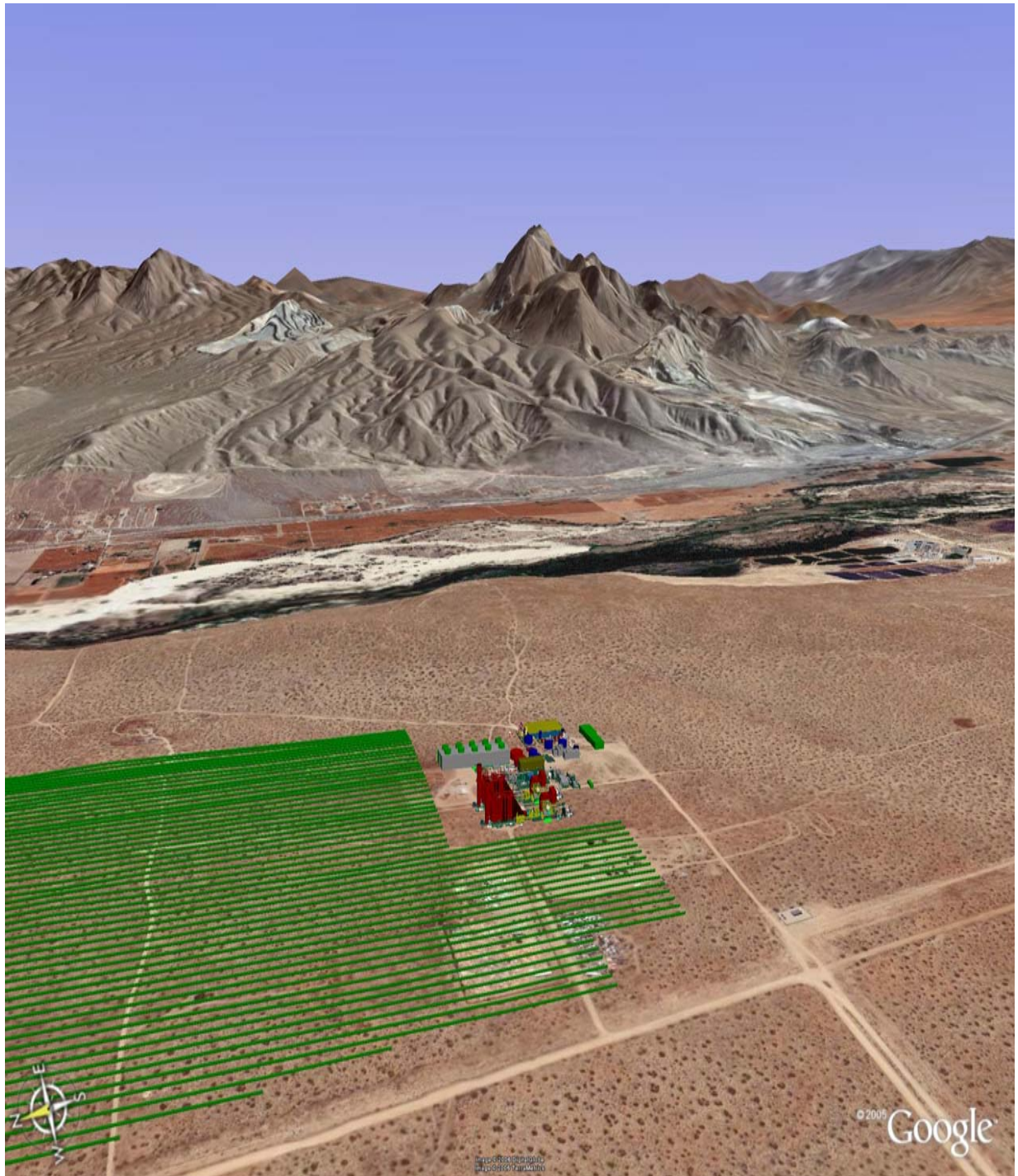
Expect to Pay for AERMOD and Training

Source	Training Cost	Model Cost
EPA http://www.epa.gov/ttn/scram/	-	Free
BEE-Line (BEEST Suite)	$695 (1-Day)	$1,255
Lakes Environmental (ISC/AERMOD View)	$950 (2-Day)	$1,499
Trinity BREEZE (AERMOD/ISC GIS PRO)	$1,199 (2-Day)	$1,995
Trinity BREEZE (AERMOD/ISC PRO)	$1,199 (2-Day)	$795

Victorville 2 Hybrid Power Project

- VV2 Located at Southern California Logistics Airport (SCLA) near Victorville
- Inland Energy is Developer
- ENSR is Permitting Consultant
- 570 MW combined cycle (2 x 1 configuration)
- 50 MW from 250-acre solar thermal collection field
- Similar plant proposed for Palmdale

Simulated 3-D View of VV2 and Nearby Terrain



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Application of AERMOD and CALPUFF for the Victorville 2 Hybrid Power Project

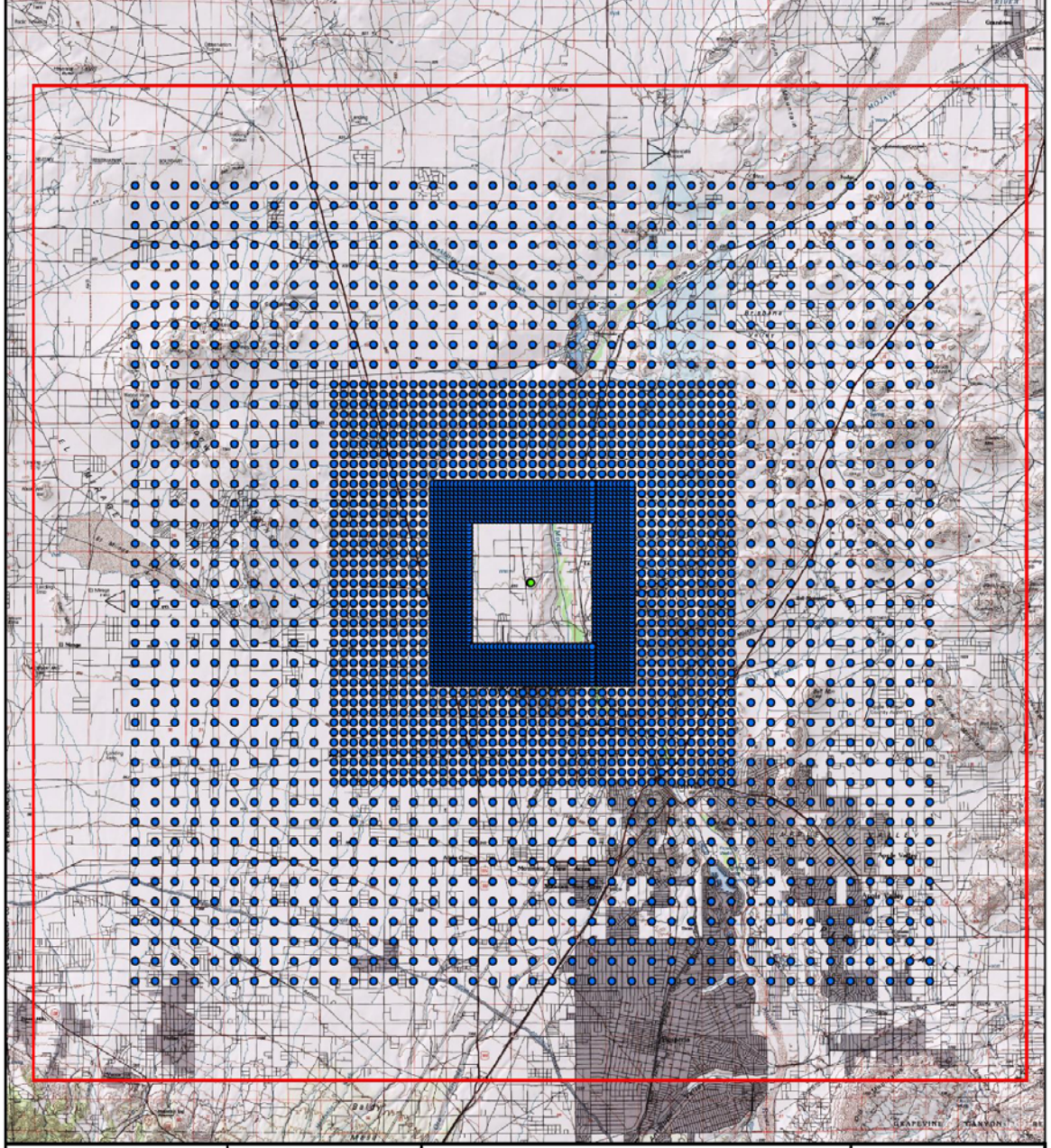
- AERMOD Application
  - Class II NAAQS/CAAQS compliance
  - Class II increment consumption
- CALPUFF Application
  - Class I impact analysis
    - NAAQS compliance
    - Increment consumption
    - Deposition
  - Regional haze/visibility assessment

Near-Field AERMOD Grid for VV2

Grid spacing 100m

Far-Field AERMOD Grid for VV2

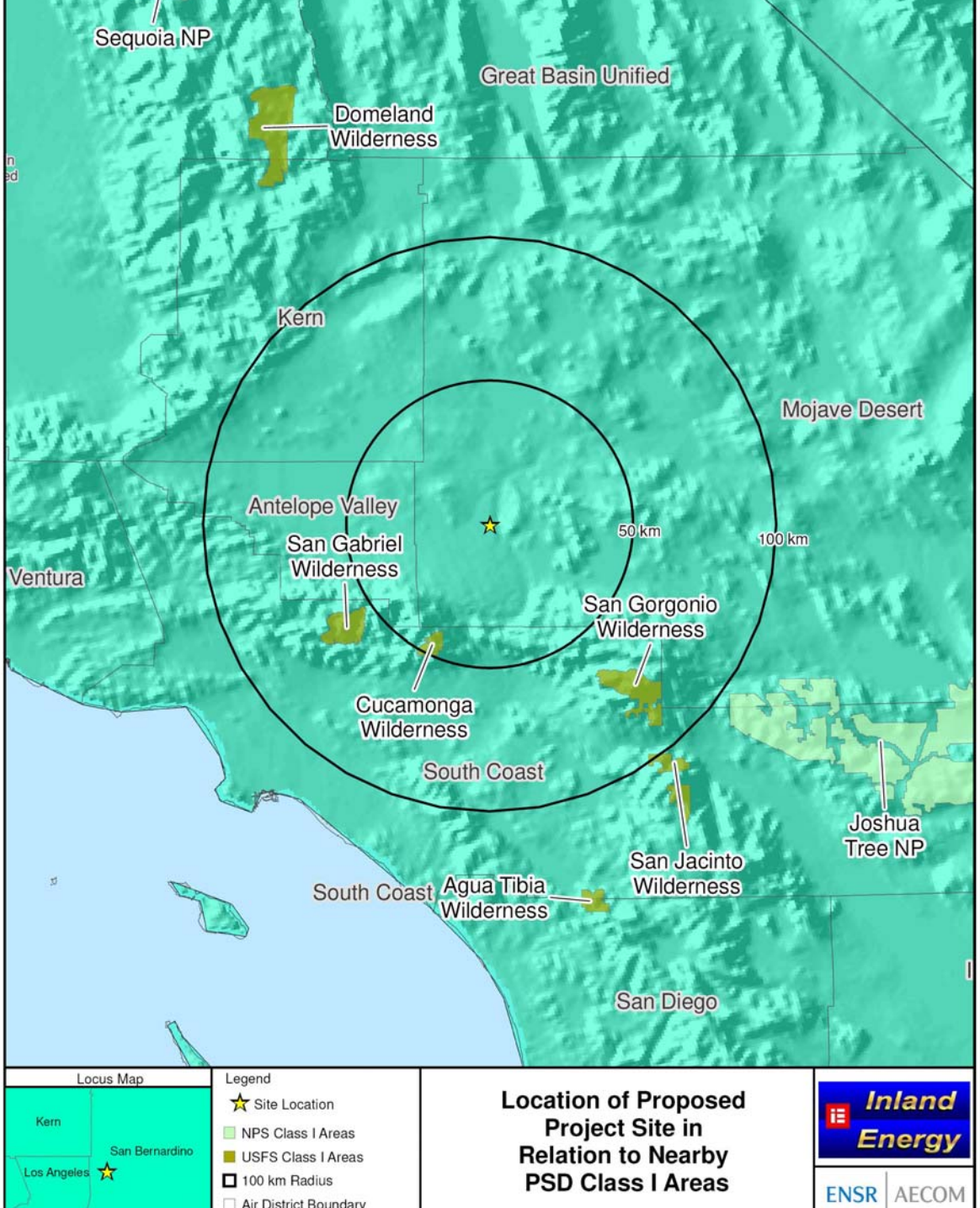
Grid spacing
200m
500m
1,000m



Class I Areas n Southern California

lass I areas ithin 100 km f VV2

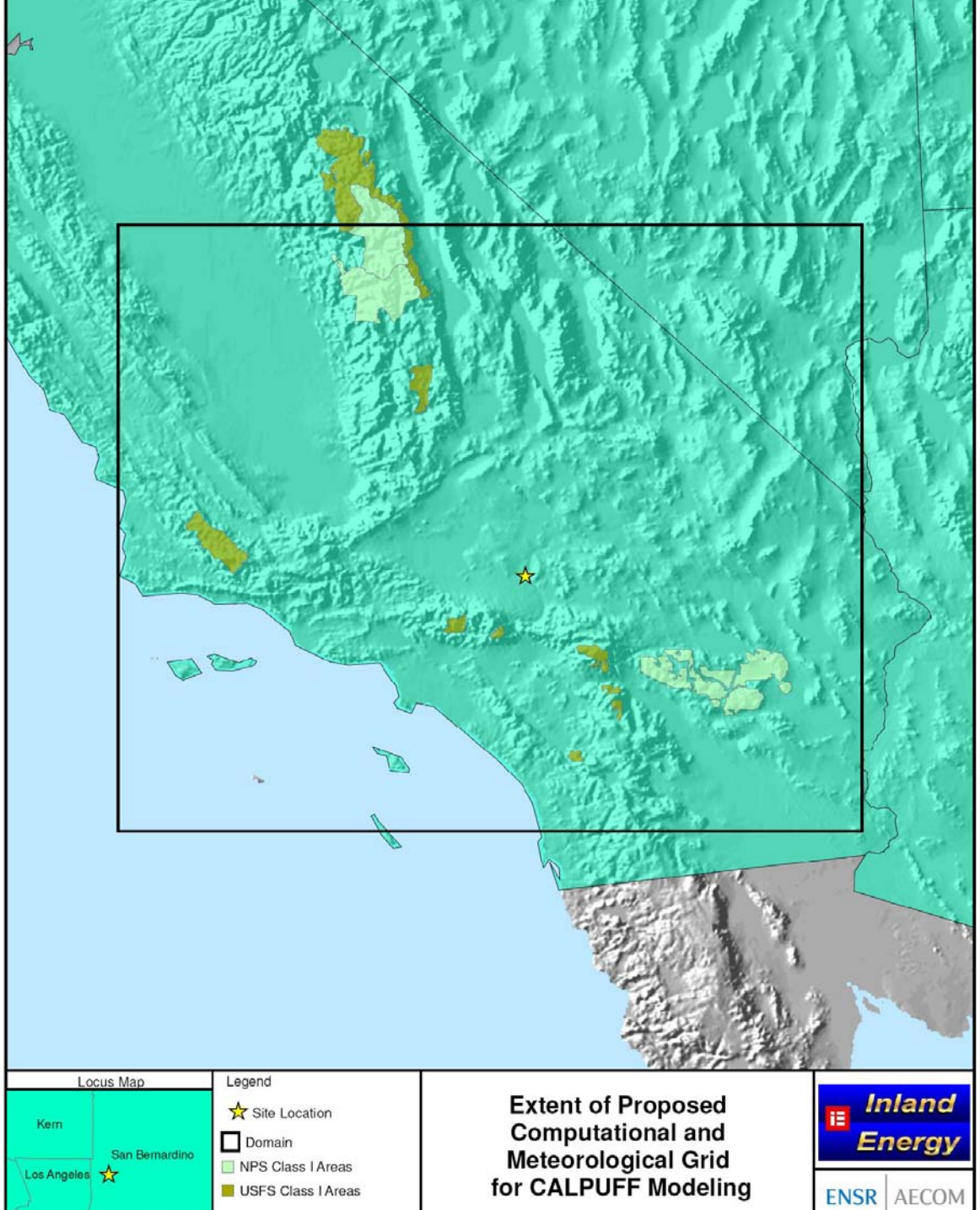
oshua Tree NP
ucamonga WA
an Gabriel WA
an Gorgonio WA
an Jacinto WA



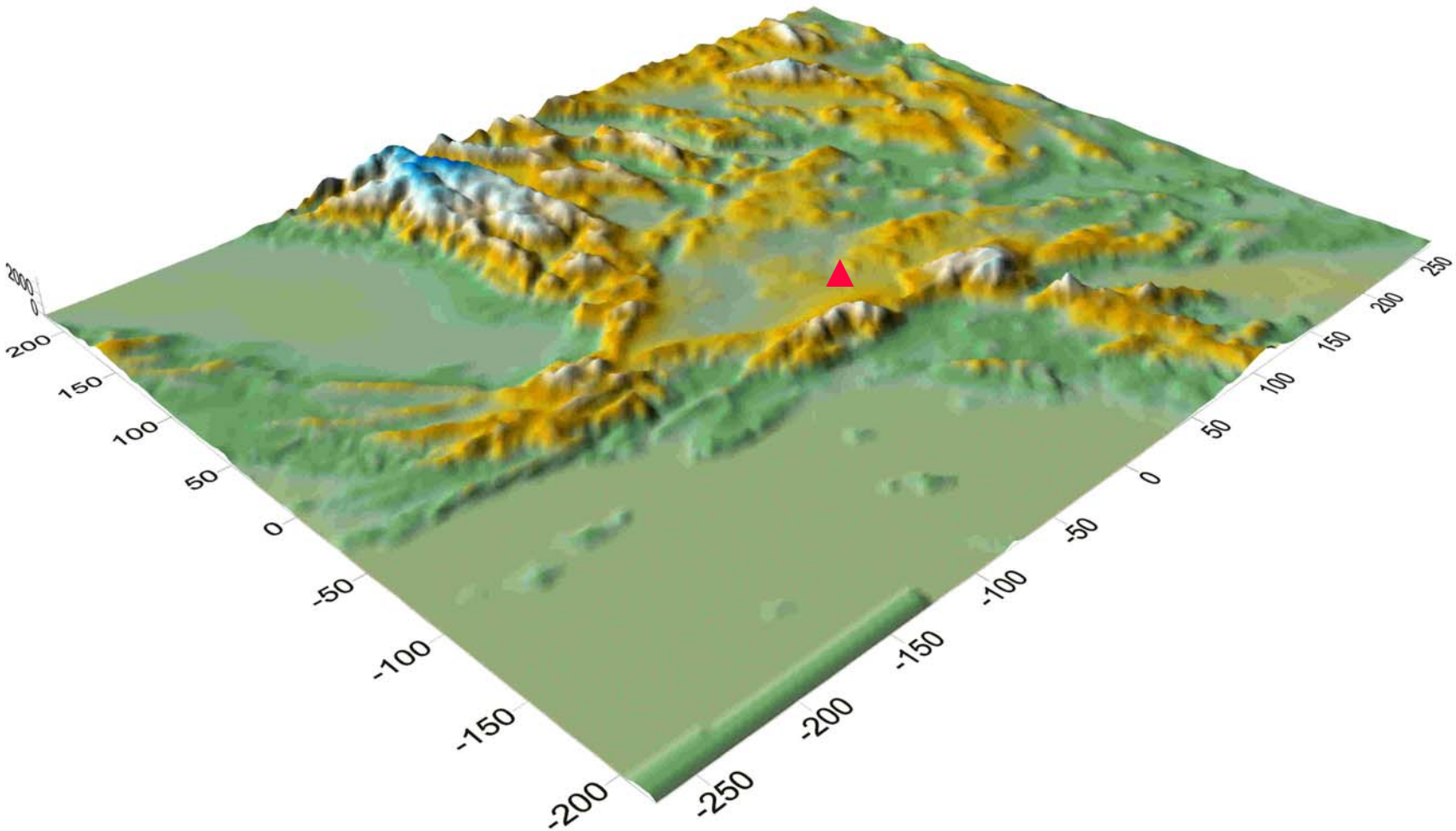
CALPUFF Modeling Domain

40 km (E/W)
41 km (N/S)

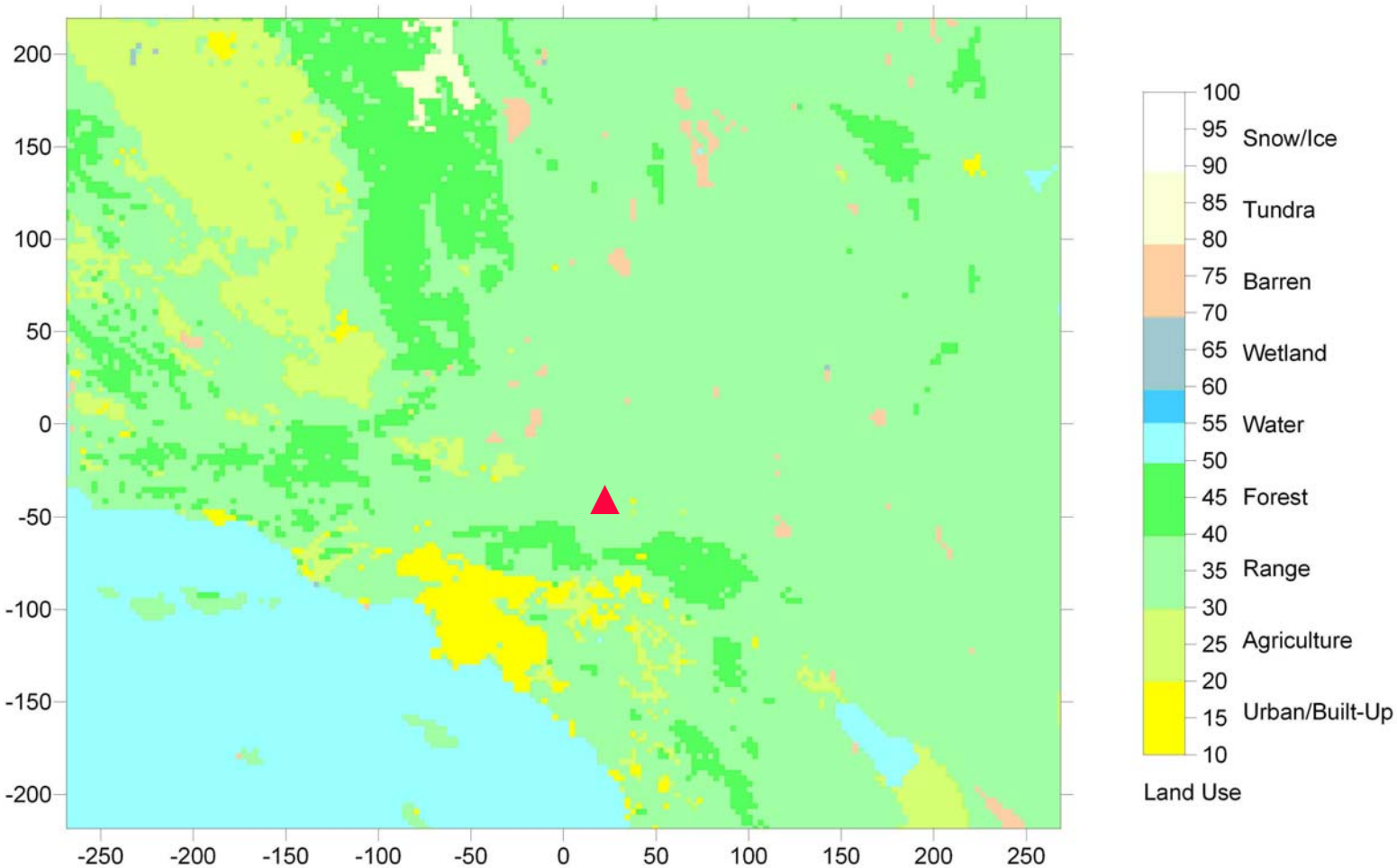
80 x 147 cells
-km grid spacing



Terrain in the CALPUFF Modeling Domain (looking NW)



Landuse in the CALPUFF Modeling Domain



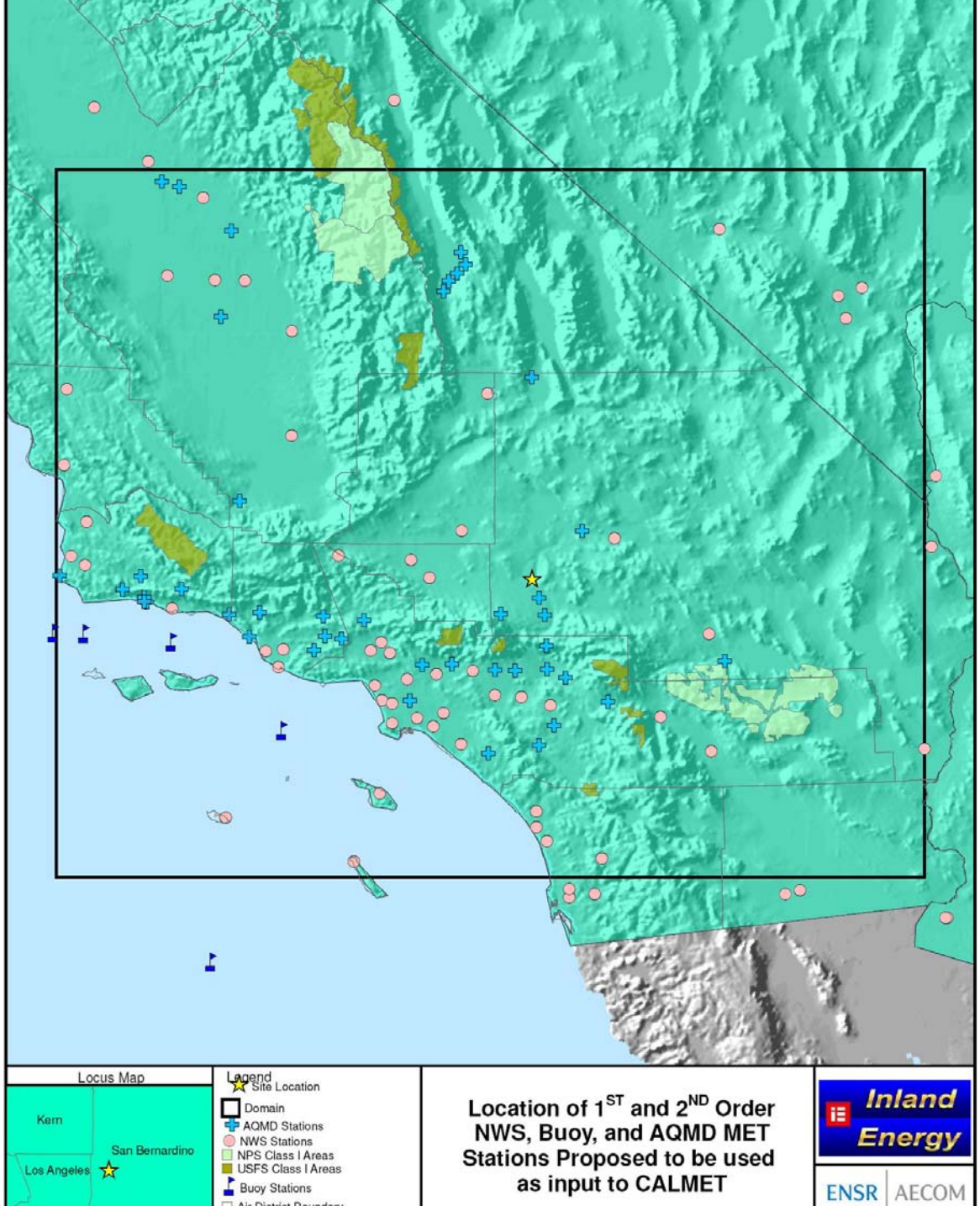
Meteorological Data

NWS, Buoy, and AQMD meteorological stations proposed as input to CALMET

-yrs MM5 data

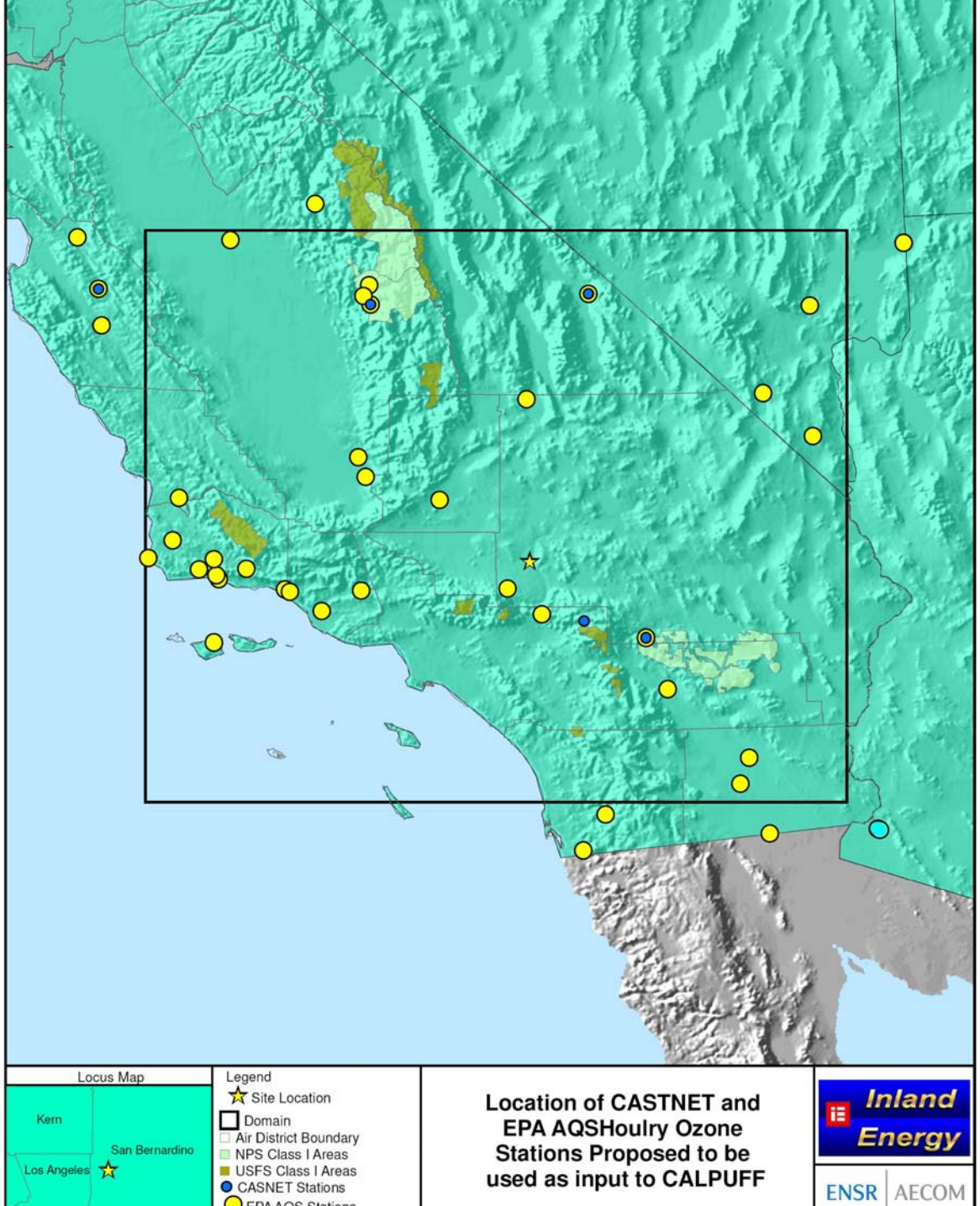
001 & 2003 at a 6 km resolution

002 at a 12km esolution



Air Quality Data

Hourly ozone stations proposed as input to CALPUFF



Parting Thoughts

1. AERMOD and CALPUFF are complex models with long learning curves

2. It takes even longer to learn to run them correctly

3. Training and Experience are essential – Get started sooner rather than later.

More Information

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